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## (54) SECURITY DOCUMENTS

(71) We, THOMAS DE LA RUE AND COMPANY LIMITED, a British Company of De La Rue House, 83/86 Regent Street, London, W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of security documents and more especially to the production of security documents provided with markings whereby the documents are rendered resistant to copying or forging and/or capable of being sorted and/or counted by means responsive to said markings.

Security documents such as, for example, identity cards, airline tickets, passports, banknotes, share certificates, bonds, lottery tickets and cheques are customarily printed, at least on certain areas, with inks which, in combination with other inks and/or the substrate, confer on the document desired security features whereby the genuineness of the document may be demonstrated and copying, counterfeiting, forging or unauthorised alteration of the value or validity of the document is made difficult. Further, it is known to provide security documents additionally with markings in "machine-readable" form whereby, in conjunction with suitable means responsive to said markings, the documents may be, for example, counted, sorted and/or verified and, optionally, caused to operate cash or service dispensing means.

According to this invention a security document comprises at least one printed marking in each ink of at least one pair of inks, the inks of each pair being of the same colour or substantially the same colour when viewed in daylight or under artificial illumination approximating to daylight but being differentiable one from another by reference to their infra-red radiation absorption properties and each ink being visible when the document is so viewed.

The inks of the said pairs must be distinguishable one from another when the markings are subjected to infra-red radiation and

determination is made of their relative degrees of absorbency thereof. It is not necessary that one ink is substantially completely absorptive of the radiation and that the other is substantially completely transparent thereto. It is sufficient that the inks absorb infra-red radiation to different discernible extents.

The markings may partially overlap one another in which instance the ink employed to print the overlying marking is preferably less absorbent of the radiation than is the ink used to print the underlying marking.

Any suitable source of infra-red radiation may be employed to demonstrate the genuineness of a document according to this invention and, if desired, the infra-red radiation may be combined with visible radiation.

The markings may be in any suitable form such as alpha-numeric characters, pictorial, symbolic data, regular or irregular lines, microprint, interference patterns, micromesh, medallion or scroll work or any suitable combination. Information may be encoded on to the document by disposing and constructing the markings in the two inks of a pair in a manner representative or indicative of given information; markings in the form of geometric shapes, for example, bar-type code markings, are particularly suitable for this purpose.

Whilst the document according to the invention may bear a marking in each of the said pair of inks suitably disposed anywhere thereon we prefer that the marking or markings in one of the said inks of the pair is or are closely positioned in relation to a marking or markings made in the other ink of the pair, thereby to facilitate a comparison therebetween.

The markings may be spaced one from another, for example, certain adjacent characters of a word figure or legend or certain adjacent lines of a design or picture may be printed one in each ink of a pair. The markings may be contiguous, for example, alternate parts of one or more lines of print may be printed one in one of the inks and the other in the other ink or parts of one or more characters may be printed in one of the inks and another part in the other ink.

Because of the nature of the inks employed to provide the markings it is apparent that the forging or counterfeiting of a document according to our invention is made difficult. For example, if a document according to the invention carries a legend in which the odd letters are markings in a first ink of a pair, the first ink being brown in colour and having a high transparency to infra-red radiation and the even letters are markings in a second ink of a pair, the second ink being of a similar colour to the first ink but having a low transparency (i.e. high absorbency) to infra-red radiation, the whole legend when viewed by normal illumination will appear to the eye as being of substantially uniform brown colour and formed of a single ink. If, however, the document is illuminated by infra-red radiation and viewed through a suitable optical device then the difference in the radiation properties of the inks will reveal that adjacent letters have been formed in different inks.

If any intending counterfeiter examines the document by visible light only he will be unaware that the genuine document is prepared with two similarly coloured inks having the different absorption properties and so will be tempted to use but a single ink in the illicit reproduction of the document. As noted above the falsity of any document so produced would be capable of ready detection. On the other hand, intending counterfeiter, as a result of his examination of a genuine document determines that two ink similar in colour but different in their infra-red radiation properties have been employed, he will then be faced with the difficult problem of obtaining or producing two inks of similar colour but having the necessary different properties. The preparation of such ink pairs is extremely difficult and the intending counterfeiter may well be deterred by this difficulty from proceeding with his purpose.

Preferably, the documents of our invention also bear printed markings in inks conventionally employed in the production of security documents such inks suitably comprising "safety inks" of permanent and/or fugitive types, known for use in the production of security documents. Such optional other markings may be applied before, during or after application to the substrate of markings in each of the said pair of inks. The markings in the said pair of inks may either be clearly distinguishable from the markings in conventional inks (for example, in the instance when the markings according to this invention are in the form of a bar code) or two types of marking may be integrated into a single pattern or picture. Preferably, this integration is so accomplished that the position of neither of the two types of marking is readily discernible in relation to the other.

A document according to the invention may be "machine-validated", i.e. its genuineness

can be demonstrated without the need for visible observation. For example, a document printed with the adjacent letters of a legend in inks having different infra-red radiation absorption properties may be viewed or scanned by a machine comprising a detector sensitive to infra-red radiation, a comparator for determining the strength of the signal emitted by the detector in response to incident infra-red radiation and indicator means operable in accordance with signals from the comparator. When the document is illuminated by an infra-red radiation source disposed remotely from the detector and the area bearing the markings is moved across the head, the latter will receive infra-red radiation varying in accordance with the different absorption characteristics of the two inks.

The detector will be influenced by two different levels of radiation reflected from the surface; when reading areas printed in the ink which does not absorb infra-red radiation it will respond to the high proportion of the incident radiation which is reflected from the surface of the paper, the radiation being transmitted through the ink, but when reading areas printed in the infra-red absorbing ink a high proportion of the radiation will be absorbed by the ink and the detector will exhibit a correspondingly lower level of response. These different levels will determine the output signal from the head and the comparator which receives these output signals will determine their relative magnitude. If this in accordance with predetermined values, the indicator means is caused to operate. If, however, the values are not in accordance with the predetermined values or a document not possessing the essential features is viewed, the indicator means does not operate thus indicating that a defective or false document has been viewed. The foregoing represents merely an illustration of one means and technique for the machine-validation of documents according to this invention; those skilled in the art will readily appreciate that other known devices and techniques may be employed.

The document of our invention may be provided with markings comprising at least one pair of inks by any technique known for making ink markings such as, for example, by printing (with paste inks such as are used for intaglio, lithographic and letter-press printing or with liquid inks such as are used for photogravure, flexographic and silk screen printing) writing, typing stamping or transfer techniques or any combination of the same.

We prefer that the document is provided with the markings by means of those printing processes (for example intaglio, lithographic and/or letter press) known for use in the production of security documents.

However, as an alternative to the use of

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the older processes one or more of the inks may be applied to a carrier body, or transfer sheet from whence it is transferred to the required position on the substrate by any suitable means comprising, for example, a typewriter or rubber stamp.

If the markings are to be provided by transfer methods, the transfer sheet or web may be of the "partial" or "total" transfer type. The "partial" transfer type is exemplified by a conventional fabric typewriter ribbon which is commonly used repeatedly because part only of the ink is transferred from any particular area corresponding to the size and shape of the pressure applying means in each use. By a "total" transfer sheet we mean that type of transfer sheet or web that is customarily used once only because, in use, a substantially total transfer, of that area of the ink layer corresponding in size and shape to the pressure applying means, occurs from the sheet to the receptive substrate.

The transfer sheet may be provided with each of the pair of said inks in complementary areas, or, optionally, with one ink only, the other ink being provided on a further transfer sheet or provided on the document by other means.

If the documents are to be provided with markings in each of the pair of said inks by means of a typewriter, it is preferred that the typewriter ribbon is similar in construction to the conventional dual ink ribbon but instead of being provided with red and black inks it is provided with each of the pair of the said similarly coloured inks; more preferably, the ribbon employed is of the "total transfer" type. Suitably, markings in each of the pair of said inks are then applied to the document by typing the desired legend or data with variation between the alternative ribbon positions, as required.

The substrate employed in the production of the documents according to this invention may be any known for such use including, for example, woven or non-woven fabrics, cardboard, paper and plastics; we prefer, however, to employ a paper substrate (optionally with a high rag content) and such may be of the type known generally as "safety paper"

having incorporated therein or thereon, water-marks, metal strips, planchetes, coloured or magnetic material coated fibres or threads, chemicals and/or other materials or any combination thereof, added so as to make unauthorised reproduction or alteration of the document more difficult.

It is within the scope of our invention to provide a document having markings thereon in more than two of the said inks. Thus, a document according to the invention, may comprise markings in each of two pairs of said inks. For example, a first pair of inks each having a similar first colour but differing infra-red radiation absorption properties may provide a first set of markings whilst a second pair of inks each having a similar second colour but differing infra-red radiation absorption properties provides a second set of markings. Further, markings in each of three or more similarly coloured inks but of differing infra-red radiation absorption properties may be provided if so desired.

Inks suitable for use in the conversion of this invention to practice may be selected by analysis of their relevant properties from commercially available or known inks. Alternatively, they may be manufactured by, for example, in the case of inks having different infra-red radiation absorption properties, adding carbon black to an ink, thereby to make it infra-red absorbing and adjusting its colour by pigment addition so that it closely matches the colour of an ink which does not absorb infra-red radiation or by producing inks of similar colours, one of which includes infra-red absorbing pigments and the other including inks which do not absorb such radiation.

Set out below are details of the composition of two pairs of inks, one pair being colour matched browns and the other being colour matched blues, and one ink only of each pair having the property of being absorptive of infra-red radiation and thus being colour-distinguishable from the other when the pair is viewed under an infra-red light source.

The figures given are parts by weight.

#### EXAMPLE I

	Brown Infra-Red Absorbing	Brown Non-Infra-Red Absorbing
Channel Black	1.2	—
Monolite Orange	12.0	—
Nitraniline Brown	—	21.0
Permanent Carmine FBH	2.3	—
"Uroset" Varnish ex-Lawter Chemicals (Uroset is a trade mark)	42.0	39.2
"Trionol" Varnish ex-Lawter Chemicals (Trionol is a trade Mark)	42.0	39.3
Mixed Drier (including Lead and Cobalt Naphthenate)	0.5	0.5
	<u>100.0</u>	<u>100.0</u>

## EXAMPLE II

		Blue Infra-Red Absorbing	Blue Non-Infra-Red Absorbing
5	Bronze Blue	15.0	—
	Calofort U	4.5	7.2
	Chromophtal Bordeaux	—	1.0
	Indanthrene Blue	—	2.5
	Monastral Blue	—	10.0
10	Monastral Green	—	0.8
	"Uroset" Varnish ex-Lawter Chemicals (Uroset is a trade mark)	40.0	39.0
	"Trionol" Varnish ex-Lawter Chemicals (Trionol is a trade mark)	40.0	39.0
15	Mixed Drier (including Lead and Cobalt Naphthenate)	0.5	0.5
		100.0	100.0

## WHAT WE CLAIM IS:—

- 20 1. A security document comprising at least one printed marking in each ink of at least one pair of inks, the inks of each pair being of the same colour or substantially the same colour when viewed in daylight or under artificial illumination approximating to daylight but being differentiable one from another by reference to the infra-red radiation absorption properties of the markings and each ink being visible when the document is so viewed.
- 25 2. A security document as claimed in Claim 1 in which at least some of the markings in the inks of at least one pair are disposed in close proximity one to another.
- 30 3. A security document as claimed in Claim 2 in which the said markings are contiguous.
- 35 4. A security document as claimed in Claim 3 in which the said markings are disposed in a partially overlying relationship.
- 40 5. A security document as claimed in Claim 4 in which the overlying marking is printed in an ink which is less absorbent of infra-red radiation than is the ink employed to print the underlying marking.
- 45 6. A security document as claimed in any one of Claims 2 to 5 in which the said markings together form the whole or a part of a printed line or character.
7. A security document as claimed in Claim 2 in which the markings comprise certain adjacent characters of a figure, word or legend.
- 50 8. A security document as claimed in Claim 2 in which the markings comprise certain adjacent lines of a design or picture.
9. A security document as claimed in any one of Claims 2 to 5 in which the markings are geometric shapes.
- 55 10. A security document as claimed in any one of the preceding claims which document also comprises additional markings printed in inks other than the inks of said pair of inks.
- 60 11. A security document as claimed in Claim 10 in which at least some of the additional markings form part of a design of which another part comprises markings in the said pair of inks.
- 65 12. A security document as claimed in any one of the preceding claims including a plurality of markings in each of one pair of said inks, said markings being so disposed and constructed as representing information.
- 70 13. Security documents substantially as hereinbefore described with reference to Example I and Example II.

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